



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/784,932	02/25/2004	Kazuo Nakajima	249420US2	9577

22850 7590 02/07/2006

OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.  
1940 DUKE STREET  
ALEXANDRIA, VA 22314

EXAMINER
----------

DIAMOND, ALAN D

ART UNIT	PAPER NUMBER
----------	--------------

1753

DATE MAILED: 02/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/784,932	<b>Applicant(s)</b> NAKAJIMA ET AL.	
	<b>Examiner</b> Alan Diamond	<b>Art Unit</b> 1753	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 15 November 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 November 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10112005</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Comments***

1. The objections to the drawings have been overcome by Applicant's amendment of the drawings.
2. The 35 USC 101 rejections and 35 USC 112, second paragraph, rejections have been overcome by Applicant's amendment of the claims other than rejections that are set forth below.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 5, 8 and 15 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

At line 4 in claims 5 and 8, and at line 3 in claim 15, the newly added term "a battery of the solar cell" is not supported by the specification, as originally filed.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Art Unit: 1753

6. Claims 5, 8, and 15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

At line 4 in claims 5 and 8, and at line 3 in claim 15, it is not clear exactly what is to be encompassed by the newly added term "a battery of the solar cell". In order to overcome the 35 USC 112, first and second paragraph, rejections of claims 5, 8, and 15, it is suggested that the following changes be made. In claims 5 and 8, delete the entire last two lines in each of these claims, and then change the word "used" at line 2 in these claims to "incorporated". In claim 15, at line 3, delete the term "as a battery of" and insert in its place "in".

***Claim Rejections - 35 USC § 102/103***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1, 2, 4, 5, 9-11, and 15 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Nakajima et al (U.S. Patent Application Publication US 2002/0139416).

Art Unit: 1753

With respect to claims 1 and 2, Nakajima et al prepares the instant multi-element polycrystal of  $\text{Si}_{1-x}\text{Ge}_x$  having the instant discrete regions dispersed in a matrix (see paragraphs 0009 to 0021, 0031, 0033, and 0034; and Figures 1A to 1D and 2A to 2D). In particular, it is the Examiner's position that the instant multi-element polycrystals prepared according to the procedure and cooling rate in paragraphs 0033 and 0034 and resultant microscopic distributions in Figures 1A to 1D and textures seen in respective Figures 2A to 2D inherently meet the claimed limitation that  $X1 < X < X2$ .

With respect to claim 4, the crystal grains are columnar shape (see Figures 2A to 2D where there are discrete regions three dimensionally dispersed in a matrix (see Figures 2A to 2D). It is the Examiner's position that the matrices in Nakajima et al's Figures 2A to 2D have strain.

With respect to claim 5, a solar cell is manufactured (see paragraphs 0014, 0019, and 0039).

With respect to claim 9, Nakajima et al prepares a multi-element polycrystal, such as one containing Si and Ge, or one containing Ga, In and As in instant claim 9, by a method comprising preparing a melt containing multi elements; and cooling the melt while controlling a cooling rate to obtain a multi-element polycrystal (see paragraphs 0027, 0033, 0034; and claims 12 and 13. The composition of the melt is controlled since one selects the amounts of elements to be melted (see paragraph 0033). It is the Examiner's position that the resulting multi-element polycrystal has the instant discrete regions dispersed in a matrix (see Figures 2A to 2D; paragraphs 0022 to 0028; and paragraph 0033 which exemplifies the method of manufacture).

Art Unit: 1753

With respect to claims 10 and 11, Nakajima et al prepares said multi-element polycrystal,  $\text{Si}_{1-x}\text{Ge}_x$  by a method comprising preparing a melt containing multi elements; and cooling the melt while controlling a cooling rate melt to obtain a multi-element polycrystal (see paragraphs 0027, 0033, 0034; and claims 12 and 13. The composition of the melt is controlled since one selects the amounts of elements to be melted (see paragraph 0033). The resulting multi-element polycrystal has the instant discrete regions dispersed in a matrix (see Figures 2A to 2D; and paragraphs 0022 to 0028). As noted above, it is the Examiner's position that the instant multi-element polycrystals prepared according to the procedure with the cooling rate in paragraphs 0033 and 0034 and resultant microscopic distributions in Figures 1A to 1D and textures seen in respective Figures 2A to 2D inherently meet the claimed limitation that  $X_1 < X < X_2$ .

With respect to claim 15, a solar cell is manufactured (see paragraphs 0014, 0019, and 0039).

Since Nakajima et al teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

In addition the instant requirement that  $X_1 < X < X_2$ , the instant strain, and the instant discrete regions dispersed in a matrix, would obviously have been present once the multi-element polycrystals prepared according to the procedure in Nakajima et al's paragraph 0033 and 0034 and resultant microscopic distributions in Figures 1A to 1D and textures seen in respective Figures 2A to 2D are prepared. Note In re Best, 195

Art Unit: 1753

USPQ at 433, footnote 4 (CCPA 1977) as to the providing of this rejection under 35 USC 103 in addition to the rejection made above under 35 USC 102.

***Claim Rejections - 35 USC § 103***

10. Claims 3, 6-8, and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakajima et al (U.S. Patent Application Publication US 2002/0139416).

With respect to claim 3, Nakajima et al prepares the instant multi-element polycrystal of  $\text{Si}_{1-x}\text{Ge}_x$  having the instant discrete regions dispersed in a matrix (see paragraphs 0009 to 0021, 0031, 0033, and 0034; and Figures 1A to 1D and 2A to 2D). In particular, it is the Examiner's position that the instant multi-element polycrystals prepared with the cooling rates according to the procedure in paragraphs 0033 and 0034 and resultant microscopic distributions in Figures 1A to 1D and textures seen in respective Figures 2A to 2D inherently meet the claimed limitation that  $X_1 < X < X_2$ . Nakajima et al's parameter M, which corresponds to the X in instant claim 3, has the value  $0 \leq M \leq 1$  (see paragraph 0010).

With respect to claims 6 and 7, the polycrystal can be  $\text{In}_{1-N}\text{Ga}_N\text{As}$ , where Nakajima et al's parameter N corresponds to the instant X (see claims 9 and 10). Thus, for example, when N is 0.5, just as M is 0.5 for the example in Nakajima et al's paragraph 0033 for SiGe, it is the Examiner's position that that the instant  $X_1 < X < X_2$  will be met, just as it is met for the SiGe.

With respect to claim 8, a solar cell is manufactured (see paragraphs 0014, 0019, and 0039).

Art Unit: 1753

With respect to claim 12, there is no parameter X in parent claim 9. In any event, Nakajima et al's parameter M, which corresponds to the X in instant claim 3, has the value  $0 \leq M \leq 1$  (see paragraph 0010).

With respect to claims 13 and 14, the polycrystal can be  $\text{In}_{1-N}\text{Ga}_N\text{As}$ , where Nakajima et al's parameter N corresponds to the instant X (see claims 9 and 10). Thus, for example, when N is 0.5, just as M is 0.5 for the example in Nakajima et al's paragraph 0033 for SiGe, it is the Examiner's position that that the instant  $X_1 < X < X_2$  will be met, just as it is met for the SiGe.

Nakajima et al teaches the limitations of the instant claims other than the differences which are discussed below.

With respect to claims 3 and 12, Nakajima et al does not specifically prepare its  $\text{Si}_{1-M}\text{Ge}_M$  polycrystal with  $M \leq 0.1$ . However, as noted above, Nakajima et al's parameter M, which corresponds to the X in instant claim 3, has the value  $0 \leq M \leq 1$  (see paragraph 0010 of Nakajima et al). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Nakajima et al's polycrystal  $\text{Si}_{1-M}\text{Ge}_M$  such that  $M \leq 0.1$  because Nakajima et al teaches that  $0 \leq M \leq 1$ , and a value of  $M \leq 0.1$  is clearly within the range disclosed by Nakajima et al. The disclosed range of  $0 \leq M \leq 1$  is limited enough so that the selection of  $M \leq 0.1$  is within the skill of an artisan practicing Nakajima et al's invention.

With respect to claims 6-8, 13, and 14, Nakajima et al does not specifically require the instant  $X_1 < X < X_2$  for its  $\text{In}_{1-N}\text{Ga}_N\text{As}$ . However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared



Art Unit: 1753

Nakajima et al's  $\text{In}_{1-N}\text{Ga}_N\text{As}$  such that N is, for example 0.5, because such is clearly within the scope of Nakajima et al's disclosure in view of the use of M of 0.5 of  $\text{Si}_{1-M}\text{Ge}_M$  (see paragraph 0033; and Figures 2a to 2D). It is the Examiner's position that that the instant  $X1 < X < X2$  will be met when N is 0.5 just as it is met when M is 0.5. Indeed, it is the Examiner's position that practically any value of M or N for Nakajima et al's polycrystals will result in the instant  $X1 < X < X2$ . This is based on the fact that Nakajima et al uses practically the same method of preparation and elements as here claimed.

### ***Response to Arguments***

11. Applicant's arguments filed November 15, 2005 have been fully considered but they are not persuasive.

Applicant points to instant Figures 1 and 2 and argues that Nakajima does not disclose or suggest that "the multi-element polycrystal includes polycrystalline grains each being formed in a crystallographic texture having discrete regions dispersed in a matrix" of claim 9. Applicant also argues that "a person of ordinary skill in the art cannot conceive that that the above-noted element of Claim 9 from the drawings in Nakajima [et al], which only shows that non-uniform microscopic distribution of elements."

Applicant argues that the Examiner provides no explanation or motivation as to why a person of ordinary skill in the art would modify Nakajima et al in order to arrive at the claimed invention. However, these argument are not deemed to be persuasive because Nakajima et al uses the exact same starting materials and method of preparation as the instant starting materials and method of preparation (see paragraph 0033 and Figures

Art Unit: 1753

2A and 2B of Nakajima et al; and page 16, lines 1-17 and Figures 8(A) and 8(B) of the instant disclosure). Accordingly, the instant requirement that the multi-element polycrystal includes polycrystalline grains each being formed in a crystallographic texture having discrete regions dispersed in a matrix is inherent in the multi-element polycrystal prepared by Nakajima et al. Indeed, instant Figures 1A to 1D, 2A to 2D, and 3, which are used to characterize Nakajima et al's Si-Ge polycrystal and solar cell are identical to instant Figures 7(A) to 7(D), 8(A) to 8(D), and 9, respectively.

Applicant argues that Figures 1 and 2 of the present application are not shown in Nakajima et al, and that these figures show a crystallographic texture having a Si rich matrix and a plurality of Ge rich discrete regions dispersed in the matrix. However, this argument is not deemed to be persuasive because as noted in the immediately preceding paragraph Nakajima et al uses the exact same starting materials and method of preparation as the instant starting materials and method of preparation (see paragraph 0033 and Figures 2A and 2B of Nakajima et al; and page 16, lines 1-17 and Figures 8(A) and 8(B) of the instant disclosure). Accordingly, the instant requirement that the multi-element polycrystal includes polycrystalline grains each being formed in a crystallographic texture having discrete regions dispersed in a matrix is inherent in the multi-element polycrystal prepared by Nakajima et al. While applicant may have found another way to characterize Nakajima et al's product as evidence by instant Figures 1 and 2, such is not indicia of non-obviousness.

Applicant argues that the "Office action does not cite any evidence in the record that a polycrystal having a non-uniform microscopic distribution of elements as

Art Unit: 1753

disclosed in Nakajima [et al] must be interpreted by those of ordinary skill in the art to teach that 'the multi-element polycrystal includes polycrystalline grains each being formed of a crystallographic texture having discrete regions in a matrix'". Applicant calls upon the Examiner, "under 37 CFR 1.104(d)(2), to supply his affidavit, including his credential to testify as one of ordinary skill in the art, setting forth that the disclosure at paragraphs [0009], [0022]-[0028], [0033], and [0034] of Nakajima would be interpreted by persons of ordinary skill in the art as only suggesting polycrystalline grains each being formed of a crystallographic texture having discrete regions dispersed in a matrix." Applicant cites In re Zurko for the proposition that substitution of improper subjective conclusion as to knowledge in the art for concrete evidence of such knowledge to a core factual finding for a determination of a patentability is improper, and cites In re Lee for the proposition that the PTO needs to provide actual evidence on the record, not unsupported opinion. The Examiner has considered Applicant's arguments and the cited case law and does not deem them to be persuasive. In particular, Nakajima et al uses the exact same starting materials and method of preparation as the instant starting materials and method of preparation (see paragraph 0033 and Figures 2A and 2B of Nakajima et al; and page 16, lines 1-17 and Figures 8(A) and 8(B) of the instant disclosure). In the only examples of preparation in both Nakajima et al and the instant specification, 1.6 g of Si raw material and 3.71 g of Ge raw material were mixed and allowed to melt, thereby preparing a melt containing Si and Ge in the same ratio (50/50); and the melt was allowed to grow through solidification while cooling it at a cooling rate of 10°C or 0.5°C to obtain the polycrystal

(see paragraph 0033 and Figures 2A and 2B of Nakajima et al; and page 16, lines 1-17 and Figures 8(A) and 8(B) of the instant disclosure). Applicant has not provided any factual evidence showing that there is a patentable difference between Nakajima et al's polycrystal and that which is claimed.

Applicant argues that claim 1 and claim 6 recite that "each of the crystal grains of the mixed crystal has a crystallographic texture composed of a plurality of discrete regions dispersed in a matrix thereof." Applicant argues that the Office action has provided no rationale for the finding of inherency of the claimed limitation of  $X1 < X < X2$ . However, this argument is not deemed to be persuasive because Nakajima et al uses the exact same starting materials and method of preparation as the instant starting materials and method of preparation (see paragraph 0033 and Figures 2A and 2B of Nakajima et al; and page 16, lines 1-17 and Figures 8(A) and 8(B) of the instant disclosure). Accordingly, Nakajima et al's multi-element polycrystal has the same properties as the instant polycrystal. Accordingly, in the absence of a showing to the contrary, the instant multi-element polycrystal prepared according to the procedure and cooling rate in paragraphs 0033 and 0034 and resultant microscopic distributions in Figures 1A to 1D and textures seen in respective Figures 2A to 2D inherently meet the claimed limitation that  $X1 < X < X2$ . With respect to claim 6, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Nakajima et al's  $In_{1-N}Ga_NAs$  such that N is, for example 0.5, because such is clearly within the scope of Nakajima et al's disclosure in view of the use of M of 0.5 of  $Si_{1-M}Ge_M$  (see paragraph 0033; and Figures 2a to 2D). It is the Examiner's position that that the

Art Unit: 1753

instant  $X_1 < X < X_2$  will be met when N is 0.5 just as it is met when M is 0.5. Indeed, it is the Examiner's position that practically any value of M or N for Nakajima et al's polycrystals will result in the instant  $X_1 < X < X_2$ . This is based on the fact that Nakajima et al uses practically the same method of preparation and elements as here claimed.

With respect to claim 3, applicant argues that with  $X \leq 0.1$ , the amount of Ge is low. Applicant argues that Nakajima et al discloses  $\text{Si}_{0.5}\text{Ge}_{0.5}$  and does not disclose what happens to the distribution of SiGe when the amount of  $\text{Si}_{0.9}\text{Ge}_{0.1}$  and  $\text{Si}_{\geq 0.9}\text{Ge}_{\leq 0.1}$  occur. Applicant argues that "it is impossible to conceive a crystallographic texture having an Si rich matrix and a plurality of Ge discrete regions dispersed in a matrix formed from merely the microscopic distribution of SiGe." However this argument is not deemed to be persuasive because Nakajima et al's parameter M, which corresponds to the X in instant claim 3, has the value  $0 \leq M \leq 1$  (see paragraph 0010 of Nakajima et al). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Nakajima et al's polycrystal  $\text{Si}_{1-M}\text{Ge}_M$  such that  $M \leq 0.1$  because Nakajima et al teaches that  $0 \leq M \leq 1$ , and a value of  $M \leq 0.1$  is clearly within the range disclosed by Nakajima et al. The disclosed range of  $0 \leq M \leq 1$  is limited enough so that the selection of  $M \leq 0.1$  is within the skill of an artisan practicing Nakajima et al's invention. Nothing unexpected has been demonstrated with respect to the selection of Nakajima et al's parameter M.

### ***Conclusion***

Art Unit: 1753

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alan Diamond whose telephone number is 571-272-1338. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m. ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

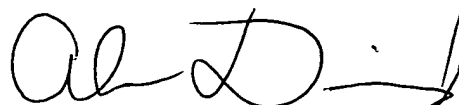
Art Unit: 1753

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Alan Diamond  
February 2, 2006

Alan Diamond  
Primary Examiner  
Art Unit 1753

A handwritten signature in black ink, appearing to read 'Alan Diamond', with a stylized flourish at the end.